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Threat, Fear, and Persuasion: Review and Critique of Questions About Functional Form

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Highlights

- Provides background on the fear/threat appeals literature.
- Reviews theoretical perspectives that predict an effect for fear on persuasion.
- Illustrates differences in between- and within-person associations between fear and persuasion.
- Delineates four necessary conditions for curvilinear effects in within-person fear-persuasion data.
- Tests for curvilinearity in an existing data set and finds that it predicts persuasion.
- Shows that individual differences in fear of needles predict different fear-response curves to a threat appeal that urges recipients to obtain a flu vaccination.
- Concludes that the research literature on threat appeals has not adequately addressed the fundamental issue of functional form.

Abstract

Theories of threat appeals have been rightly concerned with the form of the relationship between fear and persuasion: Linear or curvilinear. They have not, however, clearly distinguished the question as a between- or within-persons phenomenon. In fact, the literature often treats these two perspectives as if they were interchangeable. We show that between- versus within-person questions about functional form are distinct from one another. Previous research, which is the product of between-persons designs, shows a linear relationship between fear and persuasion. Between-persons studies cannot address the question of how changes in fear over time produce persuasion. Consequently, a major piece of the fear appeals-persuasion puzzle may have been overlooked. Reanalysis of an existing data set shows curvilinearity of fear in within-persons data and demonstrates that the curve predicts persuasion. Audience segmentation reveals different curves for different groups as well as differential associations between those curves and persuasion. Overall, the argument and the empirical results suggest that a great deal less is known about fear appeals than it is currently believed.

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Content

Fear appeals are typically conceived as messages intended to frighten recipients into compliance. Since scientific research on the topic was first initiated, one fundamental question has concerned the functional form of the fear-persuasion association (Mongeau, 1998; 2013). Early positions advanced a curvilinear prediction in which too much or too little fear minimized persuasion (Higbee, 1969; Janis & Feshbach, 1953). Messages were thought to be most effective when they hit the sweet spot represented by moderate fear.

As studies have accumulated over the last 6 decades, two propositions have become widely accepted (Ruiter, Abrahams, & Kok, 2001; Witte & Allen, 2000). First, the role of emotion in persuasion is minimal. Many writers take the position that the real action is found in cognitive variables such as the perceived danger of the hazard and the judged efficacy of the solution. Second, to the extent that fear plays any role at all, the functional form of the fear-persuasion is direct and linear, not curvilinear. There is thought to be a dose-response relationship between fear and persuasion over all practical levels of fear appeals.

In the current paper, we demonstrate that the second generalization is not nearly so secure as it is assumed to be. The curvilinear hypothesis implies two distinct fear-persuasion relationships, only one of which has been tested (see Brewer, Weinstein, Cuite & Herrington, 2004 for an analogous problem in the study of risk perception). Between-subjects studies examine the notion that individuals who are more or less scared by the message will report varying degrees of persuasion. Within-subject investigations assess the relationship between fear before (t0), during (t1), and after (t2) the message, then look to see how the resulting curve predicts persuasion at t2 or later. From this perspective, persuasion occurs when an individual experiences an increase, then a decrease in fear. There are many studies that bear on the between-subject relationship and none that tests the within-persons relationship.

This absence is consequential. There exists a gaping hole in the research literature that comes from failure to translate theory into research design. We do not know if the old theories were right because they have not been subjected to adequate test. Without first having adequate tests of the fear-persuasion association, it is impossible to address the other truism – the belief that cognitive processes are prepotent. The power of threat and efficacy judgments cannot be assessed if fear has been improperly tested. Without accurate tests of the basic process, communication theory cannot advise message design.

To clarify the nature of the problem, we provide a selective review of the fear appeals literature. Following that, we examine two research designs that could be used to test questions about the within-person aspects of fear. Finally, we re-analyze data from an existing study in a way that allows an appropriate test of the intra-individual curvilinear hypothesis.

Fear Appeals: Content and Structure

With regard to message features, fear/threat appeals are constructed of two pieces: A threat component and an action component (Freimuth, Hammond, Edgar, & Monahan, 1990; Rogers, 1975). The threat component describes the severity of the issue –the degree to which the consequences are negative and undesirable – along with the audience member's susceptibility – the likelihood that the consequences will befall the message recipient (Janis, 1967, p. 170). The action component of a fear appeal also consists of a pair of subcomponents. Response efficacy refers to the effectiveness of the recommendation in reducing or avoiding the threat, and self-efficacy refers to one's ability to perform the recommended behavior (Rogers, 1983).

In most investigations, the threat and action components are structured such that threat precedes action. This ordering is reminiscent of the classic problem-solution format that is commonly taught in courses on public address. It is intuitively appealing too in that immediately following a threat seems an auspicious time to suggest a course of action that mitigates the threat. This can be an empirical question in that the effects of ordering the threat and action components in different ways can be studied (e.g., Leventhal & Singer, 1966). Or, it can be resolved by fiat. Capitalizing on tradition, the Extended Parallel Process Model defines fear appeals as messages in a problem-solution format (Witte, 1992).

Terminology

In common parlance, scare tactics are messages that attempt to frighten recipients into compliance. This is not very different from common social scientific usage. However, this terminology assumes correspondence between the intent of the message designer and the message's effect on recipients. This assumption is incorrect in at least two ways. First, messages that are structured as fear appeals do not always produce fear. One study of public service announcements to prevent HIV/AIDS showed that only 2/3s of those fear appeals actually produced fear (Dillard, Plotnick, Godbold, Freimuth, & Edgar, 1996). Neither message structure nor content guarantees the intended effect of a specific emotional outcome. Second, messages often provoke other, apparently unintended emotions. In the HIV/AIDs PSA study, 97% of the fear appeals produced changes in two emotions and 75% evoked changes in three or more emotions. Consequently, many writers have urged that the term threat appeal be given precedence (e.g., O'Keefe, 2002). In the current paper, we bend to the weight of the past and perpetuate the use of the phrase *fear appeals* in addition to *threat appeals*. Nonetheless, threat and fear are distinct concepts. The former describes a set of message features, whereas the latter is a message effect (O'Keefe, 2003).

Finally, we clarify our use of the term persuasion. Although persuasion can mean many things (Rhodes & Ewoldsen, 2013), we gloss these distinctions and use it to reference a class of outcomes that includes message judgments, beliefs, attitudes, intentions, and behaviors. Our focus is on the form of the relationship between fear and persuasion, not on the relationships among the elements of persuasion.

Perspectives on Fear and Persuasion

The literature on fear appeals is rich with ideas, some of which coalesced into theoretical positions that analyze the association between fear and persuasion. Others discount emotion entirely and look to cognitive processes as a means of understanding the operation of threat appeals. Because our focus in this paper is fear and persuasion, the wholly cognitive theories are not informative. With the aim of focusing our discussion as tightly as possible, we examine only those frameworks that grant some substantial role to fear. Accordingly, we do not consider the protection motivation model (Rogers, 1975, 1983; Rogers & Prentice-Dunn, 1997) or the stage model (de Hoog, Stroebe, & de Wit, 2007; Das, de Wit, & Stroebe., 2003; Stroebe, 2000). Next, we offer brief summaries of three theories that include some treatment of fear as an affect.

The Drive Model

The drive model is the oldest of the social scientific theories of fear/threat appeals. In that model, fear is conceptualized as a drive that motivates people to follow the recommendation in the persuasive message, either to adopt a behavior so that potential threat can be avoided, or to stop a behavior that is harmful to one's well-being. The drive model contends that it is not fear itself that produces change. Rather, the *reduction of fear* is rewarding—it reinforces the learning and adoption of the recommended behavior. According to the drive model, when fear is aroused the recipient will become motivated to alleviate the negative emotion, just as people will seek liquid when they are thirsty and sustenance when they are hungry. Whatever is effective in reducing fear is rewarding, and thus conducive to persuasion. On the other hand, if fear is not reduced or keeps increasing, the individual will engage in some sort of defensive reaction such as denial of the danger or avoidance of the persuasive message (Hovland, Janis, & Kelley, 1953, Miller 1963). Notably, the logic is explicitly intra-individual.

Janis' (1967) extended the drive model into the family-of-curves explanation by arguing that a variety of factors can influence the shape of the curve in terms of its height, width, or kurtosis. For example, a high (vs. low) credible communicator might induce more fear because his or her depiction of danger is more believable. Relative to the low credible communicator, he or she could also reduce fear more effectively for the same reason. Janis specifically mentioned the possibility that individual differences might determine the "maximum optimal level of arousal [i.e., fear] beyond which acceptance will be adversely affected" (p. 182). In other words, Janis proposed the existence of *several curves*, each of which represents a different type of person (e.g., high vs low anxiety). Although Janis focused on the functional form of the relationship between fear and persuasion, he shifted the focus from a within-person process to differences between groups of individuals. From his perspective, it is not the process of moving from fear arousal to fear mitigation that persuades. What is important is knowledge of each person's level of optimal arousal –a between-person variable. Matching message intensity with the recipient's optimal level of arousal produces maximal persuasion.

The Parallel Response Model

The parallel response model argued that individuals make both cognitive and emotional responses to threat appeals (Leventhal, 1970). *Danger control* is "a problem-solving process" (Leventhal, 1970, p. 126) where (external) threat-relevant information in the fear appeal message and (internal) coping behaviors and the effectiveness of these coping behaviors are processed. The consequence of danger control can be instrumental—actions to avert the threat, and cognitive—attitude change and/or behavioral intention. In short, cognitive processes provide the basis for persuasion.

Fear control is an emotional process in which the recipient focuses on his or her emotional response (fear arousal) and strives to reduce the unpleasant affect. The consequences of fear control include "avoidance reaction" as well as efforts to "quiet internal signals" and "dull awareness of external danger." All of these fear control responses are hypothesized to interfere with the acceptance of the persuasive message. Fear is *dysfunctional* and explains only why persuasive messages fail or boomerang.

Leventhal asserts that danger control and fear control are conceptually independent processes, but that functionally they can compete and interfere with each other. The effectiveness of a fear appeal message depends on which process dominates: When danger control is prepotent, the message is persuasive; when fear control dominates, persuasion fails. Therefore, all else equal, a *linear and negative* association was predicted between fear and persuasion. Persons who experience the highest degree of fear will be the same persons who are most likely to reject the message. Despite the implied existence of two over time processes – danger control and fear control –the prediction is a between-persons expectation.

The Extended Parallel Process Model

Witte (1992) combined elements of the three models as well as Roger's (1975; 1983) Protection Motivation Model in her Extended Parallel Process Model (EPPM). The key extension lies in the effort to predict when danger control and fear control will take place. By putting the fear back into theorizing, the EPPM model suggests that both cognitive and emotional variables may be persuasive (Maloney, Lapinski, & Witte, 2011). According to the EPPM, a message must arouse a certain level of fear if it is to motivate message processing. Without processing, persuasion is not possible. Whether danger control or fear control will subsequently predominate is determined by fear *reduction*. When fear is successfully reduced, danger control will be prepotent and persuasion will follow. If fear is not reduced, then fear control is paramount and persuasive backfire is likely. Thus, the EPPM seems to posit an intra-individual emotion process that closely resembles the drive model (Hovland et al., 1953). Drawing from Leventhal (1970) Witte adds the distinction between danger and fear control along with the assumption of an antagonistic relationship. The model predicts two possible outcomes: The association between fear and persuasion is *curvilinear* when danger control is dominant, or *linear and negative*, when fear control is dominant. The EPPM moves seamlessly between the logic of between-persons theory and that of within-person processes.

Current Knowledge: Results of the Meta-Analyses

Several meta-analyses provide quantitative summaries of the threat appeals literature (e.g., Boster & Mongeau, 1984; de Hoog, Stroebe, & de Wit, 2007; Earl & Albarracin, 2007; Mongeau, 1998; Peters, Ruiter, & Kok, 2013; Sutton, 1982; Witte & Allen, 2000). For current purposes, there are two major findings. First, the cognitive variables are thought to explain the effects of fear appeals. There is no evidence of the threat-by-efficacy interaction that is the central prediction of protection motivation theory (Rogers, 1975, 1983; Rogers & Prentice-Dunn, 1997) and the EPPM (Witte, 1992). However, main effects for perceived threat and perceived efficacy have been observed consistently in the data (e.g., de Hoog et al., 2007; Witte & Allen, 2000, but see Peters et al., 2013).

Second, the papers all report a positive linear association between fear and persuasion. This is properly taken as evidence of the persuasive effectiveness of fear appeals (but see Earl & Albarracin, 2007 on fear appeal and HIV testing). Correspondingly, there is no evidence of curvilinearity in the data. Sutton (1982) examined the curvilinear relationship by inferring, based on a possible negative linear association between fear and persuasion when the level of fear was high. He found "meager support" (p. 314). Boster and Mongeau (1984) analyzed the quadratic effect of fear and reported that it was "within sampling error of zero" for attitude (p. 347) as well as behavior (p. 359). Similarly, Witte and Allen (2000) found "no evidence" for any kind of curvilinear relationship (i.e., U-shaped or inverted U-shaped) (p. 598). Hence, there seems to be agreement the fear-persuasion relationship is linear, not curvilinear.

Before turning to the next topic, we wish to emphasize the brevity of our summary of the literature. All of the results that we describe above are qualified by evidence of moderator variables. In other words, the data indicate that the magnitude of observed variance exceeds what would be expected by chance alone. Although our claims are accurate, there is a great deal more nuance to the literature than we are able to address within the confines of this short review. However, as we try to make plain below, one explanation for the presence of moderators aligns with the thrust of our argument: Perhaps the data suggest moderation because the true fear-persuasion relationship has not been accurately modeled.

Research Designs and the Limits of Inference

The vast majority of fear appeal investigations utilize cross-sectional research designs, typically either post-test only or pre-test/post-test. In the case of post-test only designs, participants are randomly assigned to a message condition, such as high versus low fear/threat, then asked to provide data on their emotional experience and the degree to which they accept the advocacy of the message. For any given individual, his/her score on fear is used to predict his/her score on persuasion. Because the design is between-subjects, it enables knowledge claims such as persuasion is a linear function of fear. That is, the people who are most frightened are also the people who are most persuaded. In other words, when fear and persuasion are considered *across persons*, they are positively correlated. The same general point holds true for pre-test/post-test designs. Here, fear is assessed both prior to and following message exposure. Creating a difference score allows the research to adjust for pre-message levels of fear and, in so doing, to advance knowledge claims such as, in between-person data, increases in fear are positively correlated with persuasion. On the X axis of Figure 1, individuals grouped on their fear response scores (low, moderate, and high). The Y axis scales persuasion. The figure shows two fear-persuasion associations – linear and curvilinear – but both derive from between-person data. Setting aside the complexities of moderators, the linear relationship is consistent with the meta-analyses, but the curvilinear relationship is not.

A different question is posed by the logic of a *within-persons* perspective. This is easily seen in Hovland et al.'s

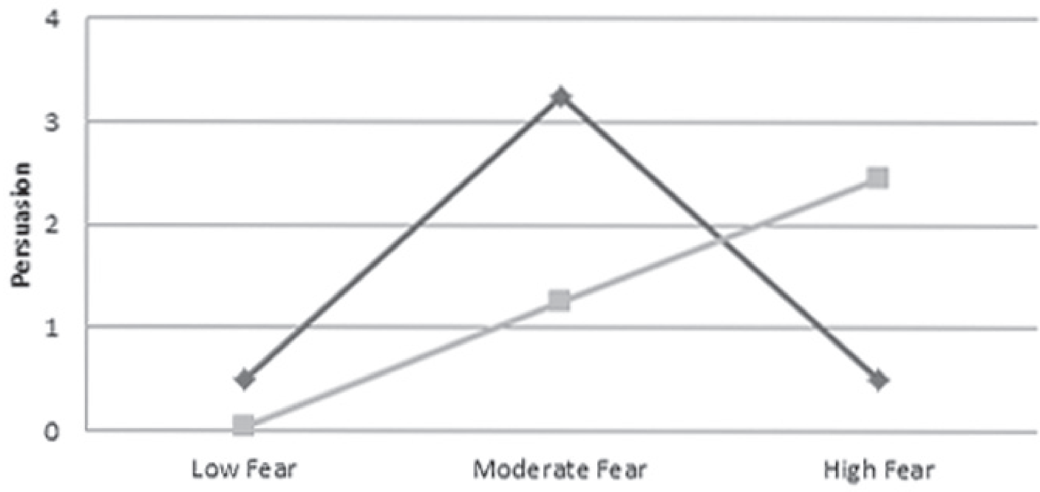

Figure 1: Linear and Curvilinear Associations Between Fear and Persuasion in Between-Subjects Data

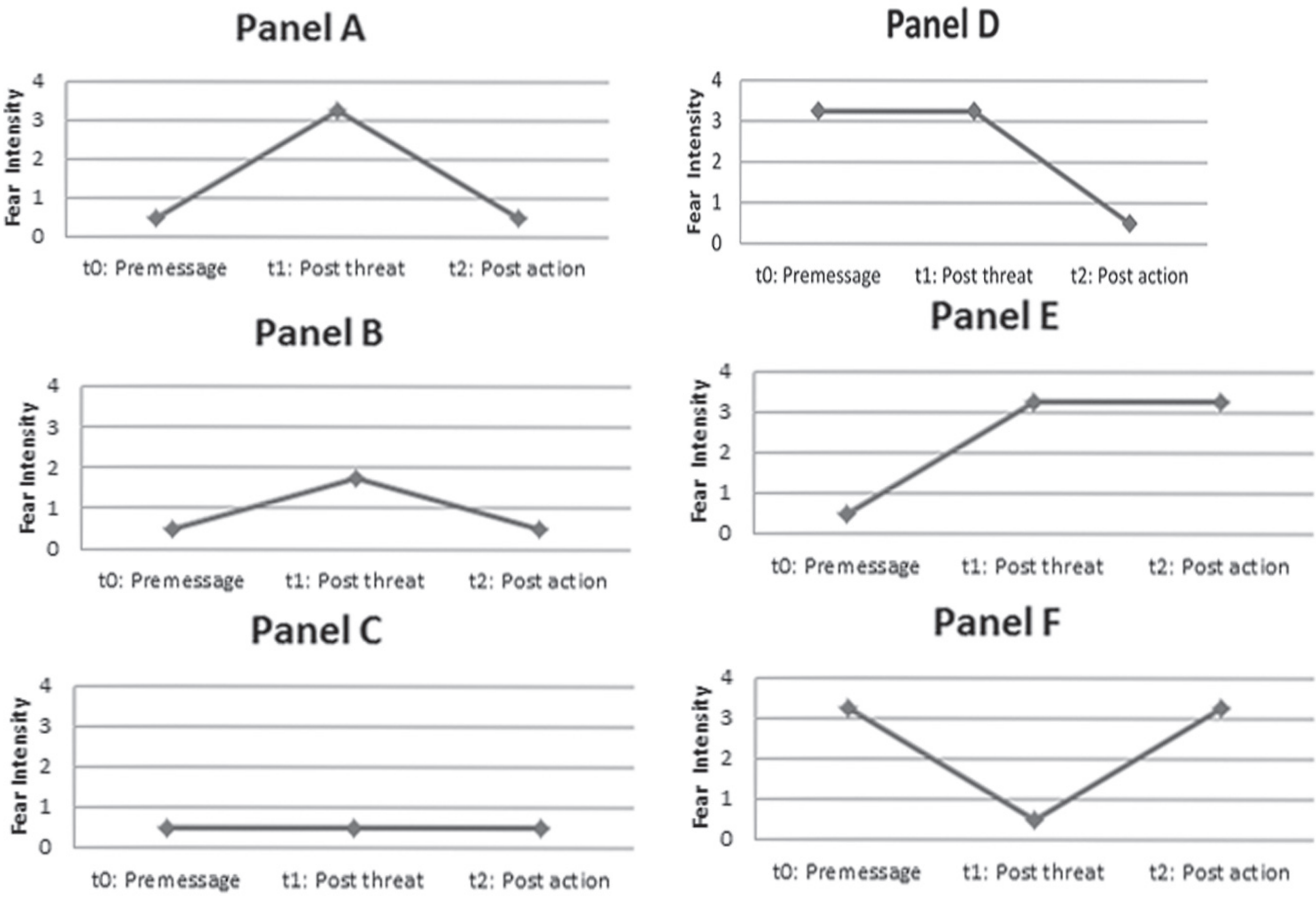

Figure 2: Hypothetical Message Effects on Fear in Within-Subjects Data

(1953) drive model: It proposes that to the extent that a message induces a drive state *and* reduces it *in any given individual*, persuasion will follow for that person. To see this, assume a study that employs a threat appeal constructed of a threat component and a recommendation component. The study measures fear response on a 0-4 scale where 0 = *no fear* and 4 = *high fear*. The fear measure is administered at three points in time: t0 = pre-message, t1 = post-threat, and t2 = post-action. One possible pattern of data is illustrated in Panel A of Figure 2, in which fear rises then falls. Although the curve appears similar to that in Figure 1, it is crucial to note that axis labels are different. Whereas Figure 1 shows fear intensity on the X axis, in Figure 2 fear intensity appears on the Y axis. And, where Figure 1 identifies a group of individuals based on a single, post-message fear score, Figure 2 tracks a single individual over three points in time.

Consideration of the three data displays implies another issue. In the 3-point longitudinal design described above, respondents provide data about their level of fear with respect to the current moment. This should be a straightforward task for respondents assuming that current emotional state is part of subjective experience and, hence, amenable to self report. But, the figures make it clear that the task might be somewhat different for participants in the standard post-test only design or a pre-test/post-test study. When asked to report their fear following message exposure, individuals might provide data on their highest level of fear (t1), their lowest level of fear (t2) or possibly some combination of the two, such as (t1 + t2)/2. The lowest-level alternative can be dismissed as implausible. The implicature of questions such as *How much fear do you feel right now?* or H*ow fearful did the message make you feel?* orients participants to the high end of the response scale. This is obvious when one considers rephrasing the question as *How little fear do you feel right now?*

If we reject the possibility that participants are reporting on their lowest level of fear, then two options remain:

Highest-level fear and some combination of fear levels during message processing. These two are more difficult to distinguish, but Rossiter and Thornton (2004, Study 1) present data that make a case for the highest-level-fear alternative. In their study, participants were asked to rate a series of public service advertisement for the degree to which they produced feelings of tension. One group provided a single, post-message judgment, whereas a separate group made continuous judgments throughout the advertisement. When the authors correlated the static (post-message judgments) with the peak dynamic scores, the resulting correlation was $\tau = .71$. This is limited information in that the coefficient speaks to patterns of covariation, not absolute values. What is needed is a study that directly contrasts the degree to which who report a peak value of X also report a static value of X. Nonetheless, the Rossiter and Thornton data do indicate that static judgments move in tandem with peak dynamic judgments. Lacking better data, we proceed on the premise that post-message reports are best interpreted as indicative of peak fear. The assumption is important to understanding the next three panels, which illustrate other possible response patterns.

In Panel D, the individual is fearful prior to the message. The threat component does nothing to amplify the pre-existing level of fright, but fear diminishes after exposure to the action component. Panel E shows a pattern in which threat provokes fear above baseline, but the action segment fails to assuage that emotion. The response pattern in Panel F illustrates a U-pattern (not an inverted-U). One notable feature of Panels D, E, and F is that their maximum fear values are all 3.25 on a scale of 0-4. Despite their obvious differences, a between-subjects research design in which participants D, E, and F report only their peak fear would all produce the same result: Fear = 3.25. Clearly, if the pattern of fear response is important to understanding the effects of threat appeals, between-subject designs are not suitable.

Summary of the Argument

The implications of Figures 1 and 2 are substantial. They take us to the key problem in the literature and the one that motivates this paper. Post-test only and pre-test/post-test studies are able to assess fear *in an aggregate* –the mean of a group or a sample – but unable to assess different patterns of emotional change *within an individual*. The studies that undergird meta-analytic conclusions about fear appeals provide sound data for testing the linearity or curvilinearity of across-person hypotheses. We can be confident that the between person association of fear and persuasion is linear and not curvilinear. Yet, most existing studies simply cannot speak to within-person emotional responses or the effects of within-person emotional variation on persuasion. Although drive theory proposed an intra-person curvilinear relationship as early as 1953, it seems that this fundamental prediction has not yet been given adequate test. There are, however, two papers that are relevant to questions concerning the functional form of the fear-persuasion association over-time (Dillard & Anderson, 2004; Rossiter & Thornton, 2004). Both projects contain over-time data on fear *and* persuasion. Because they might shed light on the foundational question of functional form, they deserve close analysis. We turn to that task next.

Research Designs for the Dynamic Properties of Fear

As teachers of geometry explain, a minimum of three points is needed to express a curve. An illustration of this minimalist approach can be found in Dillard and Anderson (2004), in which research participants provided data on their fear response at three points in time. Participants in the study read either a high threat or low threat message that described the negative consequences of contracting the influenza virus. The high-threat version contained more vivid language and a more personal narrative than the low-threat version. Both messages also contained a recommendation or action component, which was the same across conditions. The action component described the benefits of vaccination and discussed how students could obtain the vaccination at no cost from the on-campus health service.

Research participants provided data on their feelings of fear (a) before exposure to the message, (b) after the threat segment of the message, and (c) after the recommended-action segment of the message. These data were gathered over the course of minutes in one laboratory session: Just the time that it took participants to read the message and provide their reactions to it. In the same

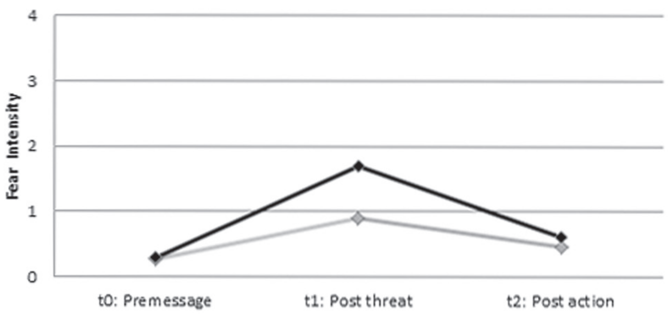

Figure 3: Results of Dillard and Anderson (2004): Vaccination message.

Note. High threat version of messages appears in black. Low threat version in gray.

session, persuasion was assessed by change in behavioral intention to obtain an influenza vaccination at the University Health Service, that is, post-message intention minus pre-message intention.

The results for fear arousal are displayed in Figure 3. As the image shows, the high threat message produced a greater peak level of fear than did the low-threat message. Following the recommendation component of the message, however, participants in both threat conditions reported similar levels of fear. It is notable that Panels A and B are similar to the two curves in Figure 2. However, recall that A and B are intended to represent data from a single individual, whereas the Dillard and Anderson figure shows mean scores within message, but across individuals. The data in Figure 3 illustrate the effectiveness of the threat manipulation across individuals, but the display hides the variability of between-persons curves.

The Rossiter and Thornton (2004) project is distinguished by the use of a continuous response measure (Algie & Rossiter, 2010, utilize the same method but do not measure persuasion). In Study 1, research participants viewed seven different anti-speeding advertisements. While viewing, they used a dial mechanism to provide continuous data at 10 samples per second on an 11-point, bipolar scale. The five scale points to the right of neutral represented varying degrees of tension, whereas the five points to the left represented relief. On the basis of the resulting data, the authors chose two of the seven advertisements for use in Study 2, where the outcome measure was persuasion. The aim of Study 2 was to assess the extent to which two different fear curves produced persuasion. Complexity was added to the investigation by gathering data from different groups who were exposed to the messages one, two, and three times.

One message (*Trike*) showed children riding tricycles on a driveway. A child steered into the street where he was hit by a speeding driver. When research participants first viewed this message, it produced tension-arousal pattern with no decay (see Figure 4). This is similar to Panel E of Figure 2 in that both curves begin near 0, then rise and flatten out. But, Figure 3 shows data that were averaged across participants, not single-subject data as depicted in Panel E. When participants were shown the message a second and a third time, the average tension data near the end of the message began pointing downward. That is, message repetition yielded curves that increasingly approximated an inverted-U. The pattern is similar to Panel A, but it is across-persons data, not within-persons data.

The second commercial (*Pizza*), showed a pedestrian being struck by a speeding automobile, a surgeon com-

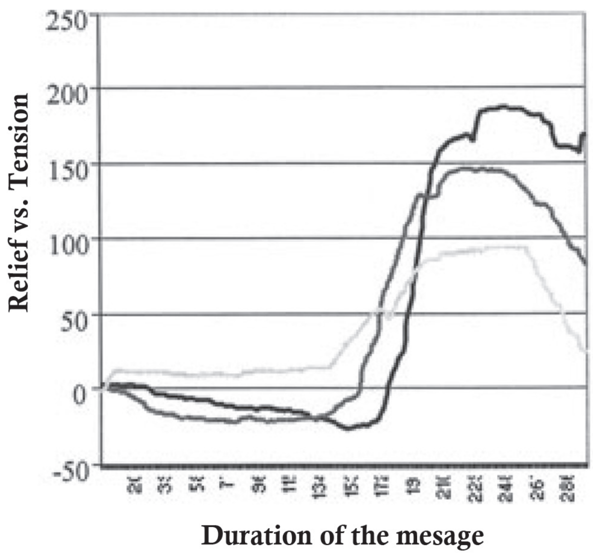

Figure 4: Results of Rossiter and Thornton (2004): Trike message.

Note. Black bar represents one exposure, gray is two exposures, and light gray is three exposures. Used with permission of the publisher. Adapted from Rossiter, J. R., & Thornton, J. (2004). Fear-pattern analysis supports the fear-drive model for road safety TV-ads. Psychology & Marketing, 21 (11), 945-960. doi.org/10.1002/mar.20042. Used with permission of the publisher.

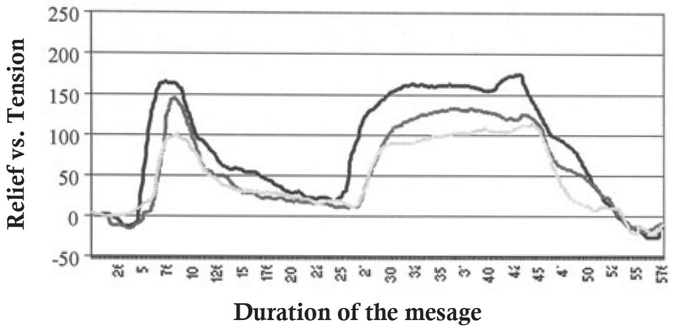

Figure 5: Results of Rossiter and Thornton (2004): Pizza message.

Note. Black bar represents one exposure, gray is two exposures, and light gray is three exposures. Used with permission of the publisher. Adapted from Rossiter, J. R., & Thornton, J. (2004). Fear-pattern analysis supports the fear-drive model for road safety TV-ads. Psychology & Marketing, 21 (11), 945-960. doi.org/10.1002/mar.20042. Used with permission of the publisher.

menting on how speed caused the injury, a slow motion reenactment of the accident, then a recommendation from the surgeon to drive more slowly. When plotted over time and across respondents, the tension-relief data generated by the *Pizza* message showed a double-bump tension-relief pattern (see Figure 5), as if Panel A of Figure 2 were repeated over time. Multiple exposures of the message produced curves with increasingly lower peaks and higher valleys as shown by the differently colored lines in Figure 5.

Both of the studies discussed above illustrate three of the necessary conditions for testing a curvilinear fear-persuasion association over time. For one, the research design must be capable of generating a curve. Operationally, the design must measure fear three or more times. Dillard and Anderson (2004) assessed fear exactly three times. In Rossiter and Thornton (2004), the messages varied in length. However, because fear was assessed 10 times per second the number of observations was 10 X message length.

Second, the pattern of fear response must show a curve for at least some of the respondents. If the fear data do not curve, the curve cannot predict persuasion. Third, there must be some inter-individual variation in the curves. Given the existence of individual differences on every variable imaginable, it would be remarkable if there were no individual variations in either paper. This requirement can also be inferred from the data displays. In Dillard and Anderson (2004), there are at least two curves that correspond to the high and low threat conditions. Hence, there are at least individual differences by condition. Graphs of the Rossiter and Thornton (2004) data yield the same conclusion. They demonstrate the requirement for inter-individual variation by virtue of different curves for each of the three different levels of message exposure.

Given the data from the two studies just described, it might appear that at least some empirical generalization could be advanced regarding the effect of intra-individual fear responses on persuasion. This would not, however, be true because the conditions listed above are necessary, but not sufficient. The existence of within-person, over-time curvilinearity in the fear response does not guarantee that the pattern produces persuasion. How to assess the association between the curve of a predictor variable and the score on an outcome variable is a separate question.

Testing for the Effect of Curvilinearity in Dynamic Data

Dillard and Anderson (2004) attempted to examine the effects of the curve on persuasion in piecemeal analyses. They tested for the impact of fear increase, peak fear, and fear decrease by entering each term in subsequent blocks in hierarchical linear regression analyses (p. 921). Thus, in separate analyses, two features of the curve were contrasted against each other. Fear increase and peak fear could not be disentangled due to multicollinearity among the predictors. However, both were substantially better predictors of persuasion than fear decrease. A major shortcoming of the analytic procedure is that it was capable of looking at only *half* of the change in fear across the entire message exposure, that is, either increase or decrease. The method could not fully test any of the patterns illustrated in Panels A-F. Despite the fact that the data meet the necessary conditions for testing intra-individual curvilinearity, the analytic method used in the paper does not. Thus, we remain uncertain about the fear-persuasion association.

Rossiter and Thornton (2004) conducted an experiment in which participants were exposed to either *Trike* or *Pizza* once a week for three weeks (Study 2). Following the third exposure, participants took part in a video driving simulation that assessed their tendency to speed up or slow down in six scenarios. Relative to a no-message control group, both messages caused participants to drive more slowly. Via comparison with the data collected earlier, the authors conclude that a pattern of tension-relief is persuasively effective. Although defensible at the time and given the available data, the analytic procedures were not capable of providing a within-persons analysis of the effects of fear pattern on persuasion. Because only tension-relief messages were contrasted with the no-message control, one can conclude that the no-message condition was not as persuasive as message condition. Hence, again, despite the curvilinear pattern of fear response, we remain uncertain about the fear-persuasion association.

In recent years, more rigorous procedures for the analysis of dynamic data have diffused throughout the scientific community. Generally speaking, there are two approaches that could be used to address questions of the effects of fear on persuasion: (a) a two-level hierarchical model that nests time within individuals (Raudenbush & Bryk, 2002), and (2) the latent growth curve (LGC) analysis in structural equation modeling (Bollen & Curran, 2006; Hancock & Lawrence, 2006). Which of the two methods might be preferred depends on the aims of the researcher. However, utilization of one of the techniques constitutes a fourth necessary condition for evaluation of the intra-individual version of the curvilinear hypothesis.

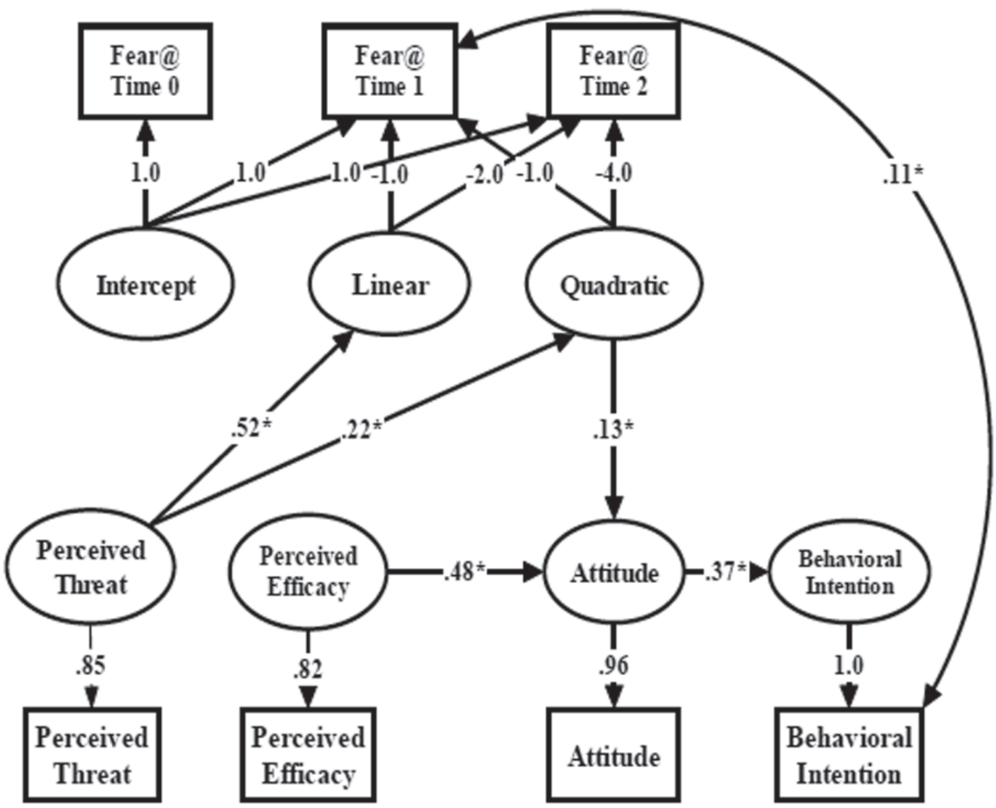

Figure 6: Re-analysis of the Dillard and Anderson (2004) Data Using Latent Growth Curve Modeling

Note. The model shows standardized path coefficients from the obtained extended quadratic model. For clarity, the error terms for the indicators, the associations among the intercept, linear and quadratic components are not presented, nor is the association between threat and efficacy.

An Empirical Example

As described, the data produced by Dillard and Anderson (2004) meet the necessary conditions for test of the within-persons curvilinearity hypothesis: (a) The research design is capable of generating a curve, (b) the data manifest curvilinearity, and (c) there is inter-individual variation in the intra-individual curves. The main shortcoming of the Dillard and Anderson project was the application of an analytic technique that could not fully examine the prediction of interest in the current paper. To provide a suitable test, we re-analyzed their data using LGC analysis. An illustration of the obtained model derived is given in Figure 6.

A detailed description of the methods and results are provided in Appendix A. However, the high points of the results can be summarized here. First and foremost, the path from the quadratic term to attitude is positive and significant. Given the codes assigned to the intercept, linear, and quadratic terms (see Appendix A), this result means that an inverted-U pattern predicts attitude toward obtaining an influenza vaccination. This evidence is compatible with the central prediction of drive theory, that is, persuasion is the result of a rise, then offset in fear. To our knowledge, this is the first satisfactory test of the hypothesis in the history of fear appeals.

The results contain other surprises. In particular, we modeled persuasion in Figure 6 as a process in which attitude causes behavioral intention. This is justifiable in light of strong theory and sound empirical evidence (Ajzen, 1991; Fishbein & Ajzen, 2010; Kim & Hunter, 1993). However, the bidirectional arrow from fear at t1 to behavioral intention is notable. This empirical result means that peak fear influences change in intention to obtain a flu vaccination independent of the curvilinear effect (see Appendix A for more detail). In narrow terms, the finding is the same as that reported in Dillard and Anderson (2004). It can be construed more broadly as consistent with the meta-analyses, which report that fear intensity is linearly associated with persuasion. In other words, the same data set reveals one pattern that is consistent with classic between-persons analyses and another effect that is wholly novel. The fact that both effects are present in the same model indicates that each is present while controlling for the other. This complexity is not foreseen by any existing theory.

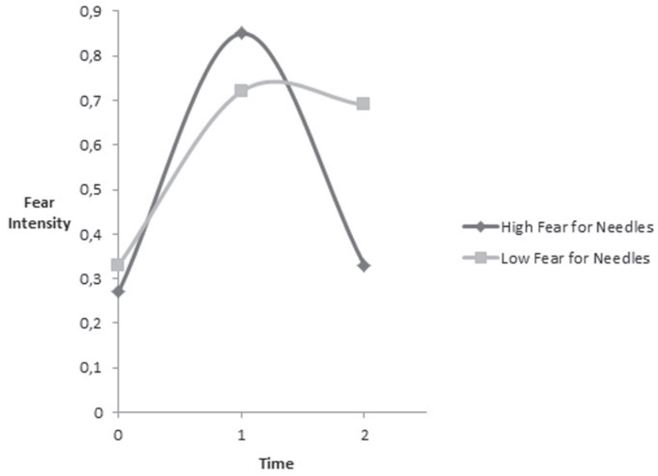

Figure 7: Latent Estimates of Change in Message-Inducing Fear Among Persons High and Low in Fear of Needles

Finally, the data present the opportunity to evaluate a variant of Janis's (1967) idea that there might be different curves for different groups or persons. Though not reported in the 2004 publication, Dillard and Anderson measured individual differences in fear of needles.

Because high fear-of-needles is associated with avoidance of medical treatment involving needles (Wright, Yelland, Heathcote, & Ng, 2009), it seemed a valuable candidate for audience segmentation the current project. More explicitly, fear of influenza was the focal point of the advocacy in Dillard and Anderson (2004) and the expected motivator of persuasion. Fear of needles could be seen as an irrational byproduct of the message and a potential obstacle to persuasion. When we partitioned the over-time fear data on fear of needles (median split: high versus low) it produced the two curves that appear in Figure 7. From the top-most curve in the illustration, it is apparent that message-induced fear rose, then diminished among persons high in fear of needles. For low fear-of-needles individuals, message-induced fear increased from pre-message to post-threat, but showed almost no decline from post-threat to post-action. Importantly, the path from the quadratic component to attitude in the high fear-of-needles groups was $\beta = .28$, $p < .05$, whereas the corresponding values for the low fear group were $\beta = .07$, ns. The message-induced fear curve was persuasive in one group and not in the other. Overall, these results showed that individual differences in fear of needles did influence the trajectory of change in fear, as well as the strength of fear-persuasion relationship.

Implications of Intra-individual Curvilinearity

As suggested throughout this paper, valid tests of the within-persons curvilinearity hypothesis are absent from the threat appeals literature. The central implication of this fact is that we may know a good deal less about fear appeals than we think that we do. Such concerns are borne out by the re-analysis of the Dillard and Anderson (2004) data. We see three important ramifications:

1. No existing theory is adequate to explain intra-individual curvilinear effects. Although drive theory was the original source of the prediction, many of its basic principles have been rejected insofar as they apply to persuasion. More recent theories do not discriminate between inter- and intra-individual processes. Informed decision making about message design is impossible in the absence of basic theoretical understanding of the mediating processes.

2. Research should focus on factors that affect the shape of the curves. Surely the content, structure, and language of threat appeals should be targets of inquiry as they have been in the past. Social and contextual factors that might instigate fear prior to the message or make it difficult to reduce following the message should not be overlooked (e.g., Muthusamy, Levine, & Weber, 2009).

3. Replications are needed. The results reported here confirm the importance of understanding intra-individual processes. Yet, because they represent a single, health-related topic that derives from a smallish sample of people, they are more in the nature of a demonstration than a strong empirical generalization. When the number of studies that use within-persons designs equals the number of between-person designs that now exist, we will be able to make convincing claims about the role of curvilinear effects in threat appeals research.

Given the need for appropriate tests of the curvilinear hypothesis, it might be concluded that all future research should be designed so as to afford such tests. From a purely theoretical standpoint, this would be an advance. Still, not all research is purely or even primarily theoretical. Health communication is a case point: For a great deal of work in that area, the overriding motivation is improving health, not testing theory. Thoughtful applications of communication theory benefit from the basic science issues that are the focus of this paper. Basic science also profits from thoughtful applications of theory. Researchers should choose designs that align with their overarching goals. In the long run, the balance of internal and external validity will produce more certain knowledge than either alone. Not all fear appeals research has to test the curvilinear hypothesis. However, failure to acknowledge the potential for within-person processes will limit the degree to which applied projects are able to generate valid predictions.

Summary

Theories of threat appeals have been justifiably concerned with the nature of the relationship between fear and persuasion. Despite this, they have not clearly articulated the difference between linearity and curvilinearity in across-person research designs versus within-person research designs. We have shown that those questions (a) are distinct from one another and (b) that previous papers allow an answer to only one of them. Our re-analysis of an existing data set establishes that intra-individual emotion processes are more than speculation. Appreciation of the limits of prior research will enable novel tests of old theory and bring greater precision to the question of how messages bring about persuasion.

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Appendix A: Details of the Re-Analysis of the Dillard and Anderson (2004) Data

The data were drawn from a previously published study of 361 students enrolled at the University of Wisconsin-Madison. Participants in that study read either a high threat or low threat message that advocated obtaining a flu vaccine (see p. 917 of that paper for a description of the messages). During collection of the laboratory data, participants reported their experience of fear at three times: Before exposure to the message, after the threat segment of the message, and after the recommended action segment of the message. Persuasion was assessed by attitude toward, and change in behavioral intention to obtain an influenza vaccination at the University Health Service. Some of the measures used in the current project were not part of the original paper.

Measures

Perceived threat. Severity was measured by one Likert item: "Terrible is the word that I would use to describe the flu." Although the original study included multiple items intended to measure severity, we judged only this one to be content valid. Thus, the current analysis depended on single item to assess severity.

The response scale ranged from 1 to 5 and was anchored at every point (e.g., 1 = *Strongly Disagree*, 5 = *Strongly Agree*). Susceptibility was measured by three Likert items: "I believe if I get the flu, it's likely that I will suffer at least some of the consequences described in the message," "There is a possibility that I could suffer from the consequences of the flu," and "I believe that there is almost no chance that the problems described in the message will ever happen to me" (reverse coded) ($\alpha = .83$). For this and all other multi-item measures, a composite score was created by taking the average of the three items. Following Rogers (1975, 1983), an index of perceived threat was created by multiplying the two measures, then taking the square root to return it to the original scale (overall $\alpha = .72$ based on the sum of the four items).

Perceived efficacy. Self-efficacy was measured by three items: "It is too difficult for me to get a flu shot (reverse coded)", "If I wanted to, I could easily get a flu shot," and "If I decided to get a flu shot, there is no doubt that I would be able to do it" ($\alpha = .82$). Response-efficacy was measured via three items: "Getting a flu shot is a sure-fire way to avoid the consequences from the flu," "The way to reduce the risk of the flu is to get a flu shot," and "If I get a flu shot, then the chances of getting the flu are greatly reduced" ($\alpha = .64$). As with perceived threat an index was created by multiplying the two averaged scores, and then taking the square root (overall $\alpha = .67$ based on the sum of the six items).

Message-induced Fear. This variable was measured at three times (pre-message baseline = t0, post-threat = t1, and post-action = t2) with fearful, afraid, and scared, using a 5-point scale anchored at 0 (*with none of this feeling*) and 4 (*a great deal of this feeling*). For each time point, a composite score was created by taking the average of the three items ($\alpha = .83$, .94, and .91 respectively). The clock-time between the three fear measures varied as a function of the speed with which participants read the message. Informal observation indicated that most participants took about four minutes to read the threat component and about two minutes to read the recommendation component.

Fear of Needles. Four items (e.g., "I am afraid of needles" and "The idea of receiving an injection is scary to me" ($\alpha = .96$) assessed this variable. The items were administered as part of the pre-message battery of questions.

Attitude. Attitude toward obtaining a flu shot was measured by seven semantic differential items that used 7-point response scales: bad/good; foolish/wise; unfavorable/favorable; negative/positive; undesirable/desirable; unnecessary/necessary; and detrimental/beneficial ($\alpha = .93$). Attitude was measured once, after the recommendation component of the threat appeal.

Change in behavioral intention. Before and after reading the message, participants were asked to report the likelihood of obtaining a free flu vaccination from University Health Services during the school year. The response scale ranged from (0) *certain that I will not* to (100) *certain that I will*, with numeric anchors at 10-point intervals. Change in behavioral intention was measured by computing for each participant the shift in self-report likelihood from the pre-message to the post-message such that positive values indicated more persuasion. Intention was measured at one time only, which was after the recommendation component of the message.

Method of Analysis

Latent growth curve (*LGC*) modeling (Bollen & Curran, 2006; Hancock & Lawrence, 2006) offers a strategy for testing the fear-persuasion relationship. LGC modeling is a longitudinal technique to estimate growth trajectory that represents repeated measures of a dependent variable as a function of time and other variables. It can be used to investigate systematic change as well as between-person variability in change. An extension of the model can examine factors that influence the growth trajectory, and the impact of the growth trajectory on different outcomes (Raudenbush & Bryk, 2002; Rogosa, Brandt, & Zimowski, 1982; Willett & Sayer, 1994).

The latent factors and the growth parameters are the fixed-effects parameters for the corresponding trajectory components from a hierarchical linear modeling perspective. In a linear model, the mean of the intercept factor represents the model specified starting point of the trajectory, in our case the pre-message (t0) measure of fear. The mean of the linear slope represents the rate of change per unit change of time. In other words, the angle of a straight line that originates at t0 and passes through t1 (post-threat) and t2 (post-action).

In a quadratic model, the interpretation of the intercept factor remains the same. That for the linear component is no longer the rate of change per unit change of time, but is now equal to *the slope of the tangent line* of the curve, where time is equal to zero, that is, at the pre-message baseline. The quadratic component now describes the rate of change per unit change of time. Therefore, larger absolute values of the linear component reflect steeper curvature at the initial time point, and larger absolute values of the quadratic component reflect more rapid change in the curvature per unit change of time.

Input and Model Specifications

Table A presents the means, standard deviations and correlation matrix for perceived threat, perceived efficacy, fear at three times, as well as attitude and intention. The descriptive data show that fear was increased by the threat component from .30 to 1.29, and reduced by the action component from 1.29 to .54. These data were input to LISREL8.80 for LGC modeling analyses. Analyses proceeded in two steps. First, we attempted to establish the growth trajectory of fear across the three time points when it was measured. Second, extensions were added to the models. That is, perceived threat and efficacy were treated as predictors and attitude and behavior intention as outcomes of the fear growth trajectory.

In the linear model, the three fear variables were specified as each having a 1.0 factor loading on the latent intercept, and the loadings of 0, 1.0, and 2.0 on the latent slope. These values represent an increasing pattern with equal intervals between time points (i.e., linear and positive). The latent intercept and slope were allowed to be associated with each other, but the error terms of the three observed fear variables were not. In the quadratic model, the factor loadings for the linear component were set at 0, -1.0, and -2.0, and that for the quadratic component were set at 0, -1.0, and -4.0. These values represent a negative function of the square because the pattern specified in fear appeal theories is an Inverted-U shape. These codes mean that the change between time points is not equal intervals, but rather the difference in squares, for example, the change from Time 1 to Time 2, is not 1 unit (i.e., 2-1=1), but rather 3 units (i.e., 22-12=3). The latent intercept, the linear and quadratic components were allowed to be associated with each other. Association was not permitted among the error terms of the three observed fear variables. The predictors (i.e., perceived threat and efficacy) and outcomes (i.e., attitude and behavioral intention) of the growth trajectories were specified as single-indicator latent constructs, with their error terms fixed as (1-α) multiplied by their respective variance (Bollen, 1989).

To assess the impact of peak fear (i.e., post-threat fear) on persuasion we need to examine the path from post-threat fear to attitude and/or behavioral intention. In SEM, it is impossible to specify a path *from an observed indicator to a latent construct*. The error term of post-threat fear was allowed to correlate with that of attitude and behavioral intention. The association between the errors terms is statistically equivalent to the associations between the constructs themselves.

Criteria for Model Evaluation

The models were evaluated vis-à-vis the data in terms of theoretical sensibility and fit. Regarding the latter, four fit indices were considered. First, the Goodness of Fit

Index (*GFI*) produces values ranging from 0 to 1 with values in excess of .90 indicating good fit. Second, the Comparative Fit Index (*CFI*) produces values ranging from 0 to 1 with values larger than .90 indicating good fit. Third, Browne and Cudeck (1993) contend that values of the Root Mean Square Error of Approximation (*RMSEA*) of .08 or lower indicate reasonable fit, though values of .06 or below should be preferred. Fourth, the Bayesian Information Criterion (*BIC*) is constructed such that negative values provide evidence of model fit, while positive BIC values suggest problematic model fit (Raftery, 1995). Fit indices are informative, but insufficient by themselves to determine the value of a model. Of equal or even greater importance is the degree to which the model provides a theoretically meaningful interpretation of the data. Both criteria were applied to the models discussed below.

Results

The Linear Growth Model

The linear growth model tested the degree to which a straight line could be used to represent the three indices of fear. The model showed poor fit on most indices: $df = 1$, χ^2=183.52, RMSEA= .63, CFI= 0.0, GFI=1.0, BIC=177.63. Dramatic disagreement among the fit indices (e.g., CFI = 0.0 vs. GFI = 1.0) was a sign that the model might prove inadequate. Modification indices showed that the path from the slope to post-action fear (Fear@t2) could be freed to produce better fit. Doing so, and removing the nonsignificant association between the latent intercept and slope yielded: df =1, χ^2=1.84, RMSEA= .05, CFI=.99, GFI=1.0, BIC=-4.05. Fit indices were better overall and more consistent in this model, but a different problem was manifested: The model implied mean of the latent slope was -.45 (*se* = 0.19). This mean structure suggested that in the obtained model, fear *decreased* by 0.45 units per unit change of time (i.e., from pre-message to post-threat, and from post-threat to post-action). Conceptually, this meant that the threat component *reduced* fear in the obtained model. The descriptive statistics in Table A showed that fear did not decrease from the baseline measure during or after exposure to the threat appeal message. This was also inconsistent with existing theories and empirical evidence in the fear/threat appeal literature. Hence, the latent model was at odds with descriptive data and with reason. These results argued against the linear model.

In an effort to further evaluate the model, we also fitted the linear LGC model with the predictors (i.e., perceived threat and efficacy) and outcomes (i.e., attitude and behavioral intention) of the growth trajectories included. That model did not fit the data: df =12, χ^2=89.36, RMSEA= .14, CFI= .79, GFI= .97, BIC= 20.29. In other words, when the linear model was located in the nomological network composed of standard fear appeal constructs, it did not show acceptable fit. Overall, we concluded that was that the linear model was not a viable representation of the data.

The Quadratic Growth Model

Because the simple quadratic model was just identified ($df = 0$), it was not possible to produce fit indices. Consequently, we moved directly to a test of the extended model. With perceived threat and efficacy entered as the exogenous predictors of the growth trajectory, and attitude and behavioral intention as outcomes, the model did not fit the data. Modification indices showed that the paths from efficacy to the latent trajectory components should be removed and a path should be added from efficacy to attitude. Although such modification was only *post hoc*, it was consistent with theories and not surprising. On one hand, theories such as the reasoned action theory (Fishbein & Ajzen, 2010) and the health belief model (Champion & Skinner, 2004) suggest that efficacy can have a direct impact on persuasion outcomes. This is also consistent with meta-analytic findings regarding the main effect of efficacy on persuasion (e.g., de Hoog et al., 2007; Witte & Allen, 2000). The modified model showed a good fit to the data: df =11, χ^2=22.40, RMSEA= .06, CFI= .96, GFI= .98, BIC= -40.91. This provided evidence that there is a tension-and-relief pattern in fear experienced by the recipients throughout exposure to the fear appeal message. However, to evaluate an inverted-U prediction it was necessary to consider the model-implied growth trajectory of fear.

The model implied mean for the intercept was 0.30 (*se* = 0.05), that for the linear component was 1.25 (*se* = 0.05), that for the quadratic component was -0.52

(se = 0.18). The parameter estimates represent the grand means across all individuals (i.e., fixed effects); and the standard errors associated with each parameter estimate represent the between-individual variations (i.e., random effects). Therefore the latent growth curve of fear resulting from exposure to the fear appeal flu shot message can be expressed as:

$$y=0.30+1.25\,x-0.52\,x^2 \qquad (1).$$

Recall that the linear component is the slope of the tangent line of the curve at Time=0 (pre-message) and that the quadratic component is the rate of change. Therefore, sign of the linear component determines the direction of the curve and larger values (absolute magnitude) of the linear component reflect steeper curvature at the initial time point, and larger values (absolute magnitude) of the quadratic component reflect more rapid change in the curvature per unit change of time. This positive linear component and negative quadratic component meant that the growth trajectory of fear throughout the message exposure is in the shape of an inverted-U.

The next step was test whether or not the inverted-U predicted persuasion. Figure 6 in the main paper presents the standardized path coefficients from the obtained quadratic growth model. The path coefficient from the quadratic component to attitude was positive and significant (β = .16, p < .05). This means that quadratic change in fear within the individual has a positive impact on persuasion. Recall that the quadratic curve was specified as a *negative* function of squares (i.e., the inverted-U shape). Combined, these results showed that the association between change in fear and persuasion was in the shape of an inverted-U.

There was no significant association between post-threat fear and attitude in the obtained model (Figure 6). The association between post-threat fear and behavioral intention was β= .12, p< .05. Unlike in regression models (Dillard & Anderson, 2004), this effect is unique and independent of impact from changes of fear. That is, the error terms of observed variables are independent of latent variables in SEM. This provided evidence for a significant and positive linear association between peak fear and persuasion.

After dichotomizing the sample on fear of needles via median split, the LGC model was estimated within-group for individuals high and low on fear of needles. For the high fear-of-needles group (n = 190), the model showed good fit: df =11, χ^2=9.57, RMSEA= .00, CFI= 1.00, GFI= .99, BIC= -48.14. For the low fear-of-needles group (n = 176), the model fit was less desirable, but remained acceptable: df =11, χ^2=27.55, RMSEA= .09, CFI= .90, GFI= .96, BIC= -28.94. Given satisfactory fit, we moved toward interpretation of the specific parameters of each model. The curves for the high and low fear-of-needles groups respectively can be expressed as coefficients for the model-implied mean, the linear component, and the quadratic component:

$$y= 0.27+1.31\,x-0.55\,x^2 \qquad (2).$$
$$y= 0.33+0.60\,x-0.21\,x^2 \qquad (3).$$

The same curves are given graphically in Figure 7 in the main text of this paper. From the top-most curve in the illustration, it is apparent that message-induced fear rose, then diminished among persons high in fear of needles. For low fear-of-needles individuals, message-induced fear increased from pre-message to post-threat, but showed almost no decline from post-threat to post-action. Importantly, the path from the quadratic component to attitude in the high fear-of-needles groups was β= .28, p< .05, whereas the corresponding values for the low fear group were β= .07, ns. Message-induced fear was persuasive in one group and not the other. Overall, these results showed that individual differences in fear of needles did influence the trajectory of change in fear, as well as the strength of fear-persuasion relationship. The general pattern of findings is compatible with drive theory predictions (Algie & Rossiter, 2010). The specifics of the data pattern are somewhat peculiar. Intuitively, it seems that the high, rather than low fear-of-needles group would be more likely to maintain high message-induced fear following the action component of the message. The reverse was true. This result may be indicative of different approaches to emotional self-regulation in the two groups or due to factors not yet theorized.

Table A. *Means, Standard Deviations, and Correlations*[a]

Variable	Mean	SD	1	2	3	4	5	6	7
1. Threat[b]	3.94	.64	.72						
2. Efficacy[c]	3.87	.65	.09	.67					
3. Fear@t_0[d]	.30	.58	-.03	-.07	.83				
4. Fear@t_1[d]	1.30	1.11	.32	.04	.20	.94			
5. Fear@t_2[d]	.54	.80	.22	-.06	.27	.52	.91		
6. Attitude	5.27	1.32	.31	.48	-.03	.20	.08	.93	
7. Intention	17.54	29.73	.03	.15	-.01	.18	.06	.31	-

Note. N = 361.

a. Alpha reliabilities on the diagonal

b. Threat = square root of (perceived severity*perceived susceptibility);

c. Efficacy = square root of (response efficacy*self-efficacy)

d. Fear@t0 = pre-message baseline; Fear@t1 = post-threat; Fear@t2 = post-action.

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